



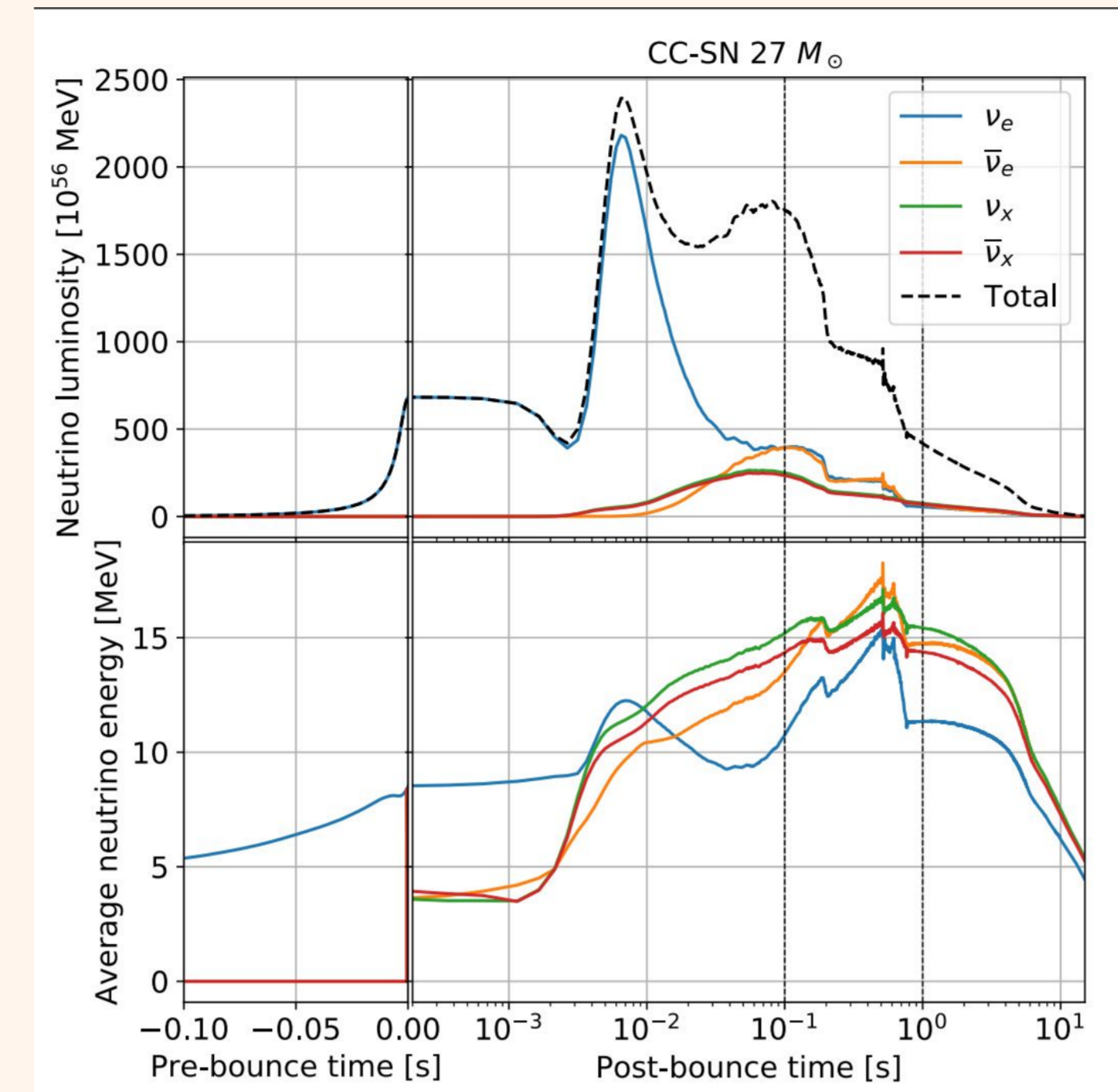
RES-NOVA: Archaeological Pb-based observatory for SN neutrino detection



Riccardo Elleboro
Università degli studi dell'Aquila
riccardo.elleboro@graduate.univaq.it

Supernova Neutrino

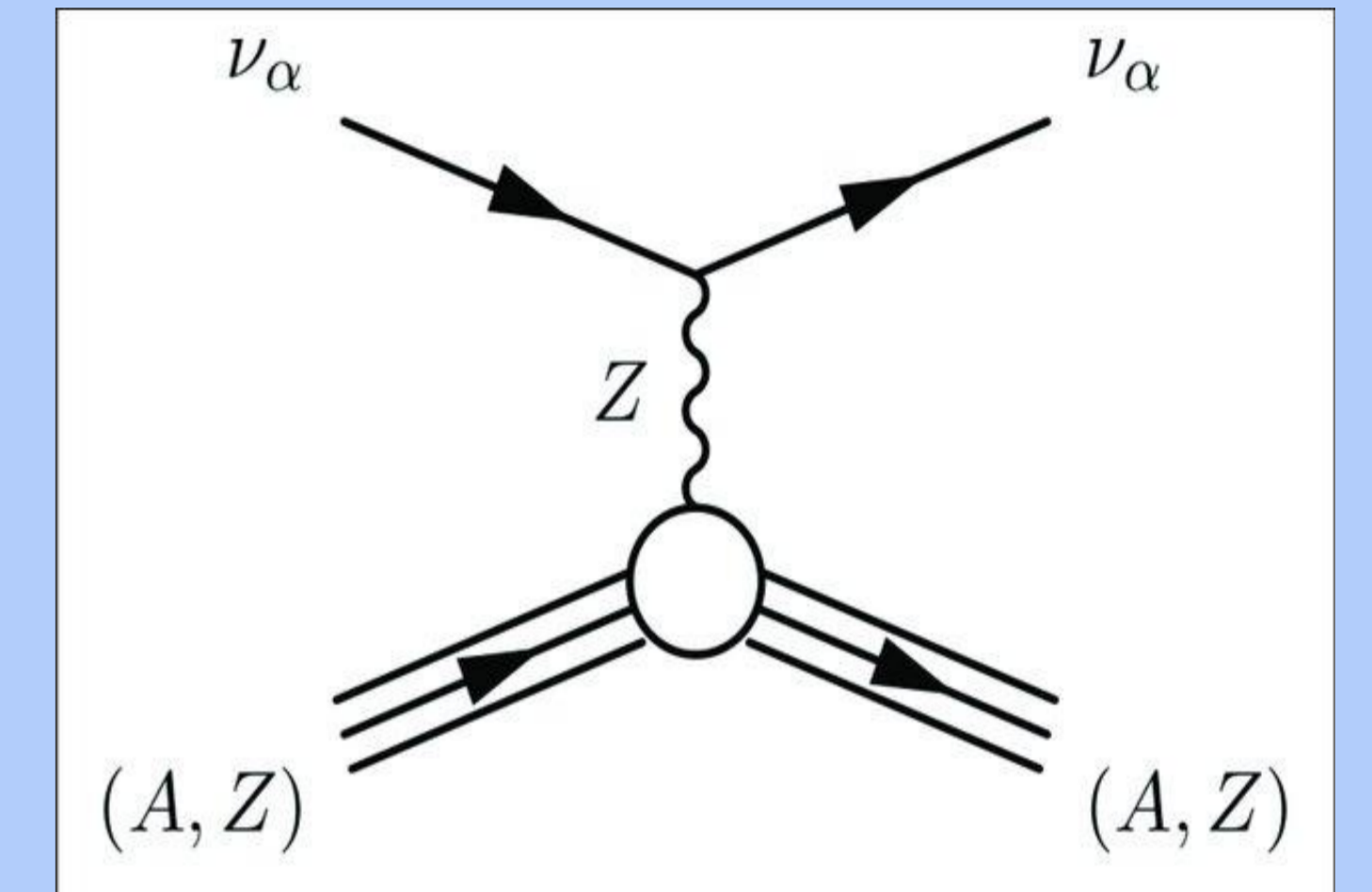
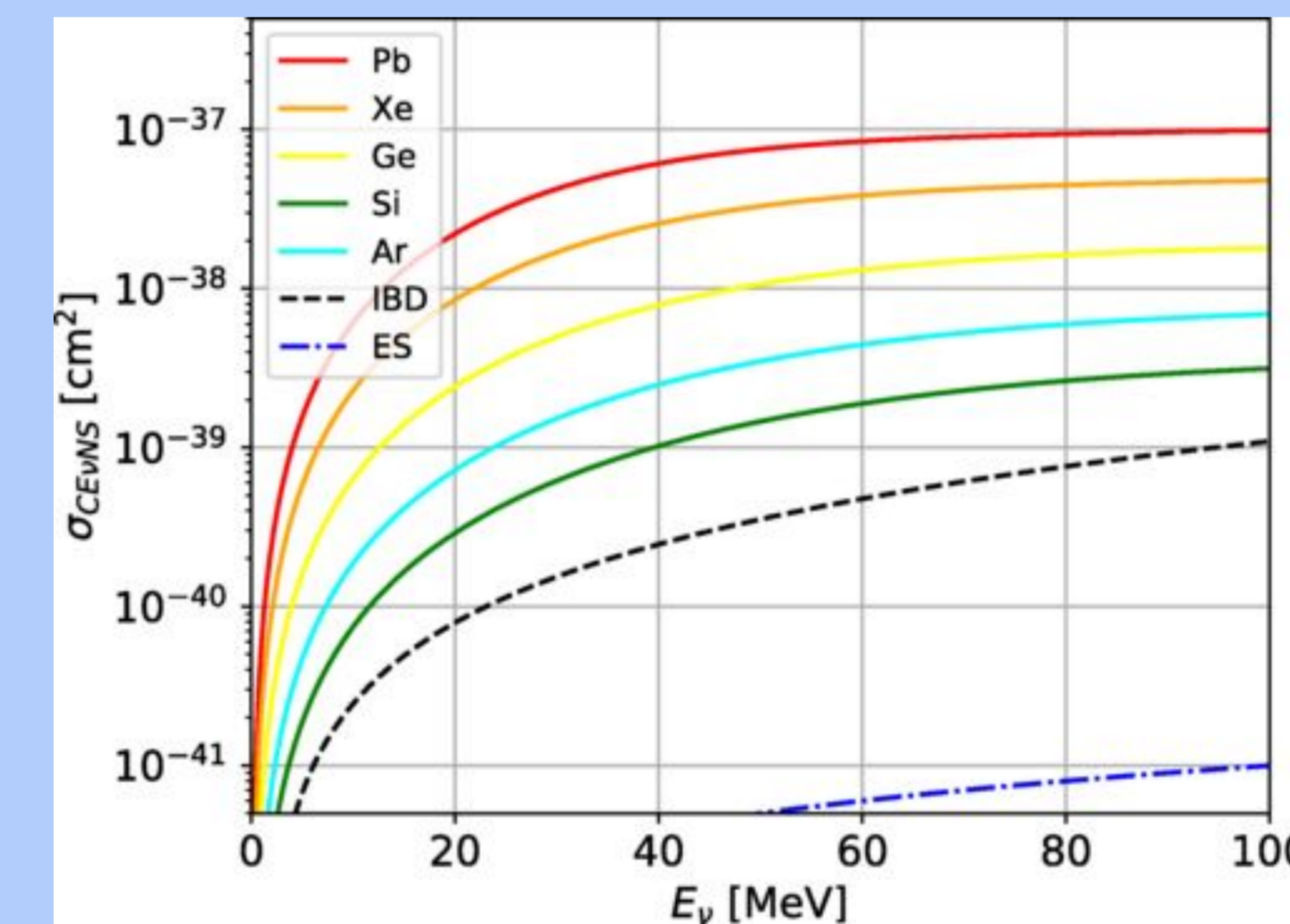
- ❖ **Supernova (SN) explosion:**
 - $\sim 10^{58}$ ν emitted in ≈ 10 s
 - Emission of all ν and $\bar{\nu}$ flavours
- ❖ **Why detecting SN- ν ?**
 - ν are the only detectable direct probes of the neutron star core
 - Study core-collapse and SN mechanisms
- ❖ Most of the current experiments are sensitive to ν_e and $\bar{\nu}_e$, $\approx 1/3$ of the total ν emission
 - Need for a **flavour independent detection channel**



CEvNS

$$\frac{d\sigma}{dE_R} = \frac{G_F^2 m_N}{8\pi(\hbar c)^4} Q_W^2 \left(2 - \frac{E_R m_N}{E_\nu^2}\right) \cdot F^2(2E_R m_N)$$

- ❖ Detection of SN- ν through coherent elastic neutrino-nucleus scattering (**CEvNS**):
 - **Equal sensitivity for all ν flavours**
 - No low-energy threshold
 - High cross section: $\sigma \propto N^2$



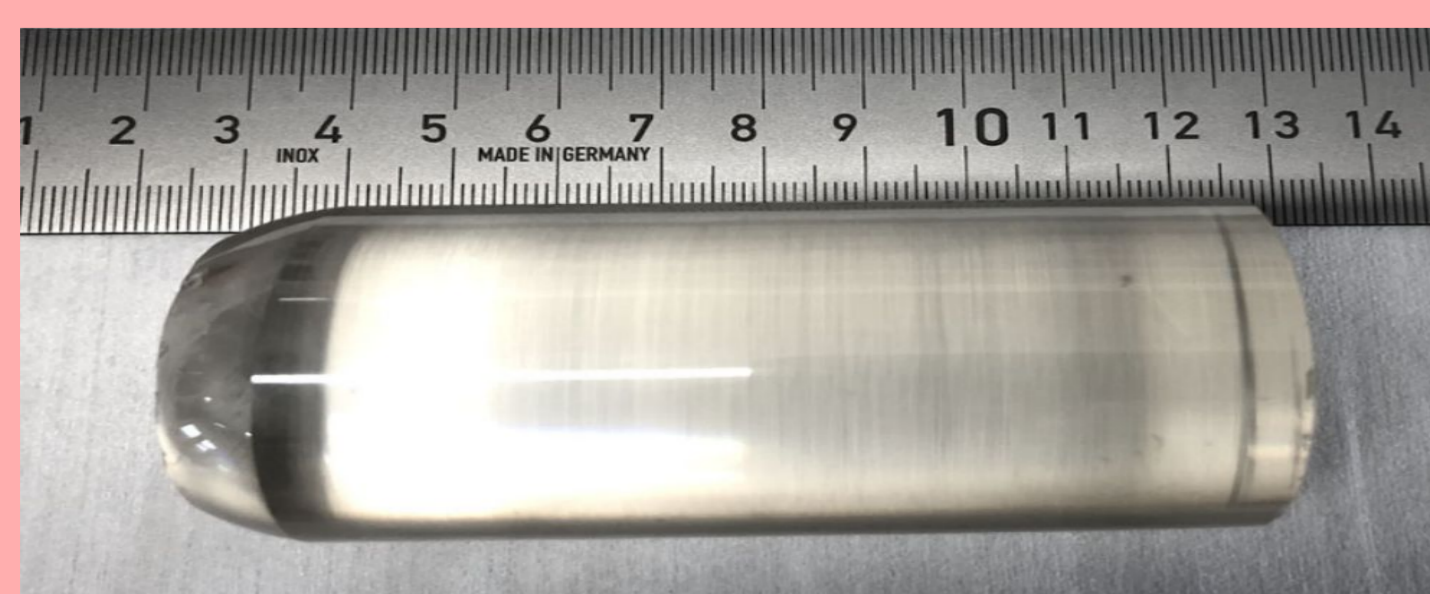
Archaeological Lead

- ❖ Why $^{arch}PbWO_4$?
 - High density ($\rho \approx 8.3$ g/cm³)
 - Large neutron number of Pb enhances CEvNS cross section
 - Excellent cryogenic performance
 - Ultra-low ^{210}Pb contamination: < 750 μ Bq/kg
 - Strongly reduced intrinsic radioactivity

2000 years ago

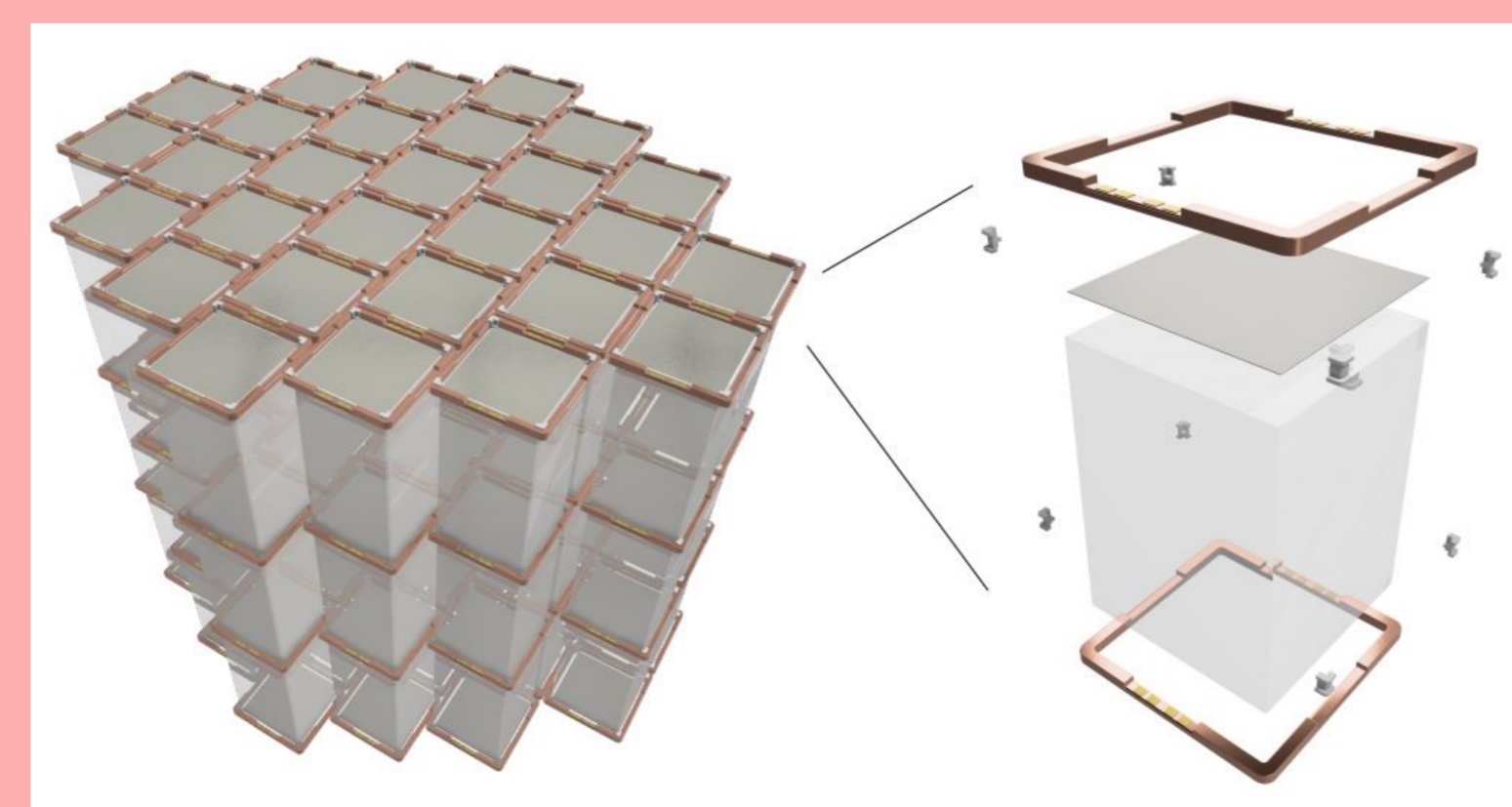
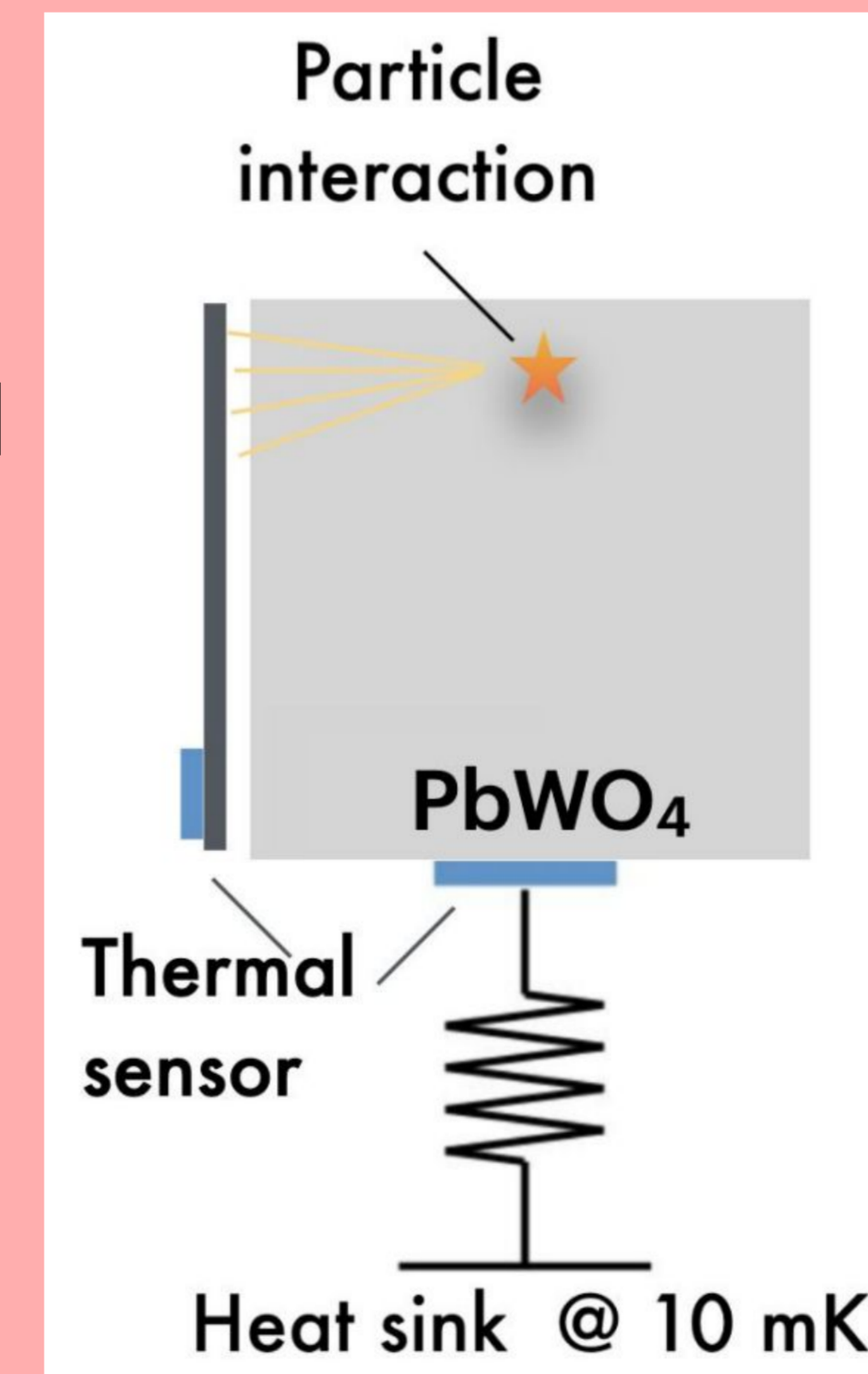


LINK TO THE ARTICLE



RES-NOVA detector concept

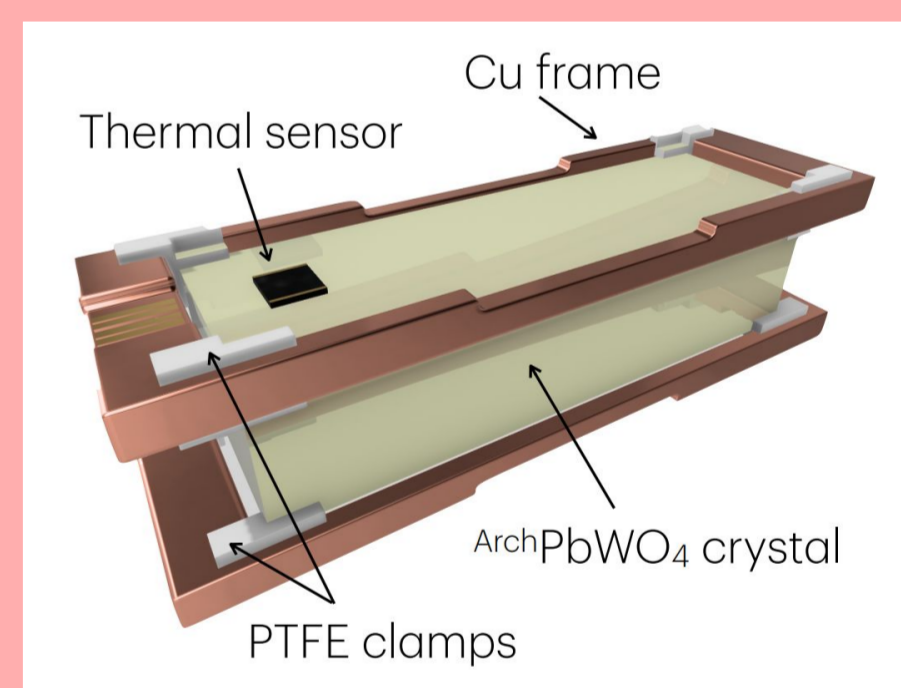
- ❖ **Low temperature calorimeters detector**
- ❖ **TES (Transition Edge Sensors)** used as thermal sensors
- ❖ Advantages
 - Excellent energy resolution ($\sigma = 200$ eV)
 - Low energy threshold (1 KeV)
 - No energy quenching
- ❖ **Double read-out (light + heat)** for particle discrimination



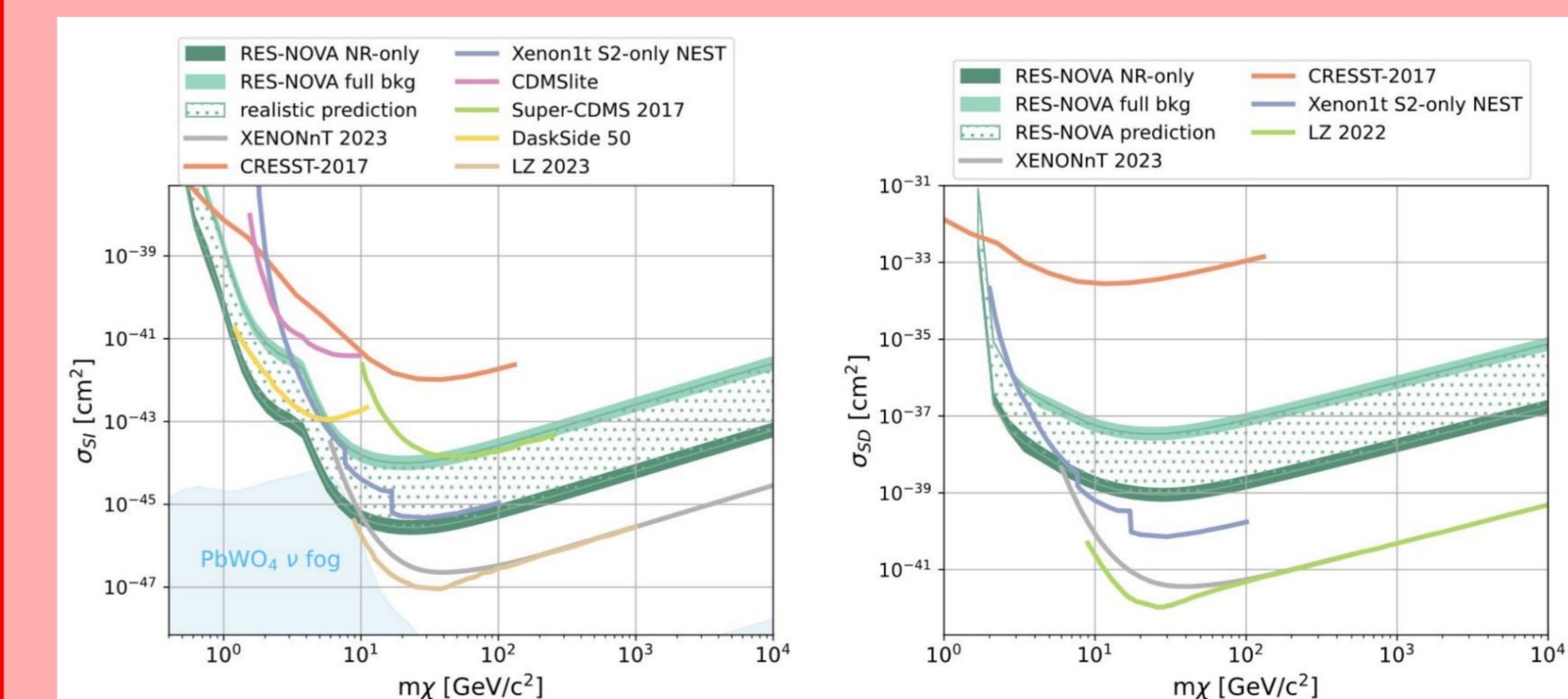
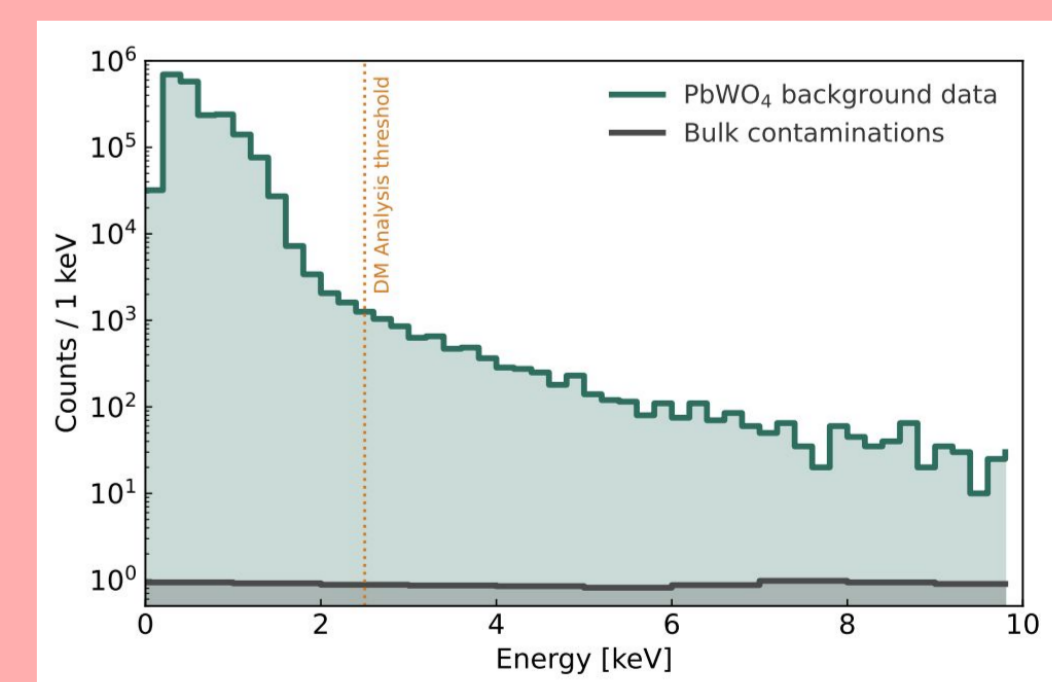
- ❖ Detector demonstrator
 - 84 $PbWO_4$ modules for a total mass of ~ 170 kg
 - Each module consists of
 - a $PbWO_4$ crystal (heat channel)
 - a Ge light detector (light channel)
 - **ROI target background:** 10^{-3} cts/keV/ton/s

Last Results

Probing **Dark Matter** interaction with **RES-NOVA prototype** cryogenic detector



- ❖ 13 g crystal equipped with an NTD, achieving an exposure of 32.4 g • day
- ❖ **Region of Interest (ROI): 2.6-10 keV**



LINK TO THE ARTICLE

